NOVEMBER/DECEMBER 2023

DPH21/GPH21 — MATHEMATICAL PHYSICS –II

Time : Three hours Maximum : 75 marks

SECTION A — (10 × 2 = 20 marks)

Answer ALL questions.

1. What is meant by analytic function?

2. State Cauchy's integral theorem.

3. If $U = 2y^2 + 3xy$, find $\frac{\partial u}{\partial x}$.

4. Write the Laplace equation.

5. List out the properties of Laplace transform.

6. Mention the properties of Fourier's theorem.

7. What is a cyclic group? Give examples.

8. Distinguish between homomorphism and isomorphism.

9. What is meant by priori probability?

10. Determine the probability that a leap year selected at random contains 53 sundays

SHANMUGA INDUSTRIES ARTS & SCIENCE COLLEGE • LIBRARY

SECTION B — (5 × 5 = 25 marks)

Answer ALL questions.

11. (a) Apply the calculus of residue to show that

$$\int_0^{2\pi} \frac{\sin^2\theta}{a+b\cos\theta}\,d\theta = \frac{2\pi}{b^2}\left(a-\sqrt{a^2-b^2}\right);\ a>b>0.$$

Or

(b) State and prove Laurent's series.

12. (a) Obtain the solution of Laplace equation in cylindrical polar coordinates.

Or

(b) Obtain the solution of the two dimensional diffusion equation.

13. (a) State and prove convolution theorem.

Or

(b) Find Inverse Laplace transform of $\frac{1}{s^2\left(s^2+\omega^2\right)}$

14. (a) Prove that the two dimensional representation of matrices, $C_4, T(E)=\begin{bmatrix}1 & 0\\ 0 & 1\end{bmatrix}$,

Or

(b) Prove that the group of order three is always cyclic.

15. (a) Fit a Poisson's distribution to the following data and calculate theoretical frequencies.

Death	0	1	2	3	4
Frequency	122	60	15	2	1

Or

(b) Find the expectation of a discrete random variable X whose probability function is given by $f(x)=\left(\frac{1}{2}\right)^x$ $where\, x=(1,2,3,4,\dots)$.

LIBRARY

SECTION C — (3 × 10 = 30 marks)

Answer any THREE questions.

16. Express the Cauchy — Riemann equation in polar form.

17. Obtain the equation of motion for the vibrating string.

18. Find finite Fourier sine and cosine transforms of the functions $f(x)=x^2$ for $0<x<4$

19. Construct the character table for C_{2v} and C_{3v}.

20. State and prove Laplace–de Moivre limit theorem of probability.
